2016

Main Contractor Selection on Construction Projects When Adapting an Integrated Project Delivery Procurement Strategy Within an Irish Context.

Fiacra McDonnell
Technological University Dublin, fiachra.mcdonnell@tudublin.ie

University of Salford MANCHESTER

College of Science and Technology

School of the Built Environment

Student name: Fiacra McDonnell

Student No. @00254012

Course: MSc in BIM & Integrated Design

Module: DISSERTATION

Date: 8th July 2016

Dissertation

Working title:

Main contractor selection on construction projects when adapting an Integrated Project Delivery procurement strategy within an Irish context.

Abstract

The Irish construction industry has experienced turbulent years over the last decade from an economic viewpoint. The industry has tended to be conservative in nature and slow to embrace change. However international influences have exposed Irish construction professionals to new more efficient systems and technologies, which although slow to take hold have started to gain traction within certain sectors of the industry. This study has focussed on the innovative procurement route known as Integrated Project Delivery (IPD), and its facilitator; Building Information Modelling (BIM). The overall aim of this study was to investigate whether Integrated Project Delivery was a viable procurement route for construction work within the Irish construction industry.

The chosen research strategy for conducting this research was qualitative in nature utilising a phenomenological approach. Semi structured interviews were deemed to be the most suitable platform for data collection, and this data was organised into solid themes for further analysis. .The participants to the study comprised of eight expert commentators from the Irish construction industry who occupied senior positions in their respective companies. An extensive literature was completed on both Irish and international literature dealing with this area.

The research question was answered based on the data gathered during the research process, supplemented by findings in the literature review. The overall conclusion based on the data gathered during this research was that IPD was a viable procurement route for construction work within the Irish construction industry, on condition that the Irish government would make policy decisions conducive to creating a collaborative environment of trust. This policy changes must deal with procurement regulations, contractual arrangements and promotion of IPD within the industry itself

Keywords; *Integrated Project Delivery, Building Information Modelling, Procurement*

Table of Contents

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 General Overview

The Irish construction industry has experienced turbulent years over the last decade from an economic viewpoint (Buildcost, 2015). Many large main contractors who were traditionally recognised in Ireland as part of the top ten elite companies on the turnover statistics, have fallen victim to the economic recession which took hold in 2009 (Hannock, 2011). The Irish construction industry has tended to be conservative in nature and slow to embrace change (Stewart, 2014). However international influences are exposing Irish construction professionals to new more efficient systems and technologies, which although slow to take hold are beginning to gain traction within certain sectors of the industry (Casey, 2015) This study has focussed on the innovative procurement route known as Integrated Project Delivery (IPD), and it's facilitator; Building Information Modelling (BIM).

Integrated Project Delivery can be defined as "a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimise efficiency through all phases of design, fabrication and construction" (Boylan, 2015, p. 15). Building Information Modelling can attract many different yet equally valid definitions, one of the simplest provided by (Pittard & Sell, 2016) who advise that "the outcome of BIM is nothing more than delivering buildings or assets more efficiently – doing what we said we would do, in the way we said we would do it and by the time we said we would deliver it" (Pittard & Sell, 2016, p. 4), to the more complex, "Building Information Modelling is an IT enabled approach that involves applying and maintaining an integral digital representation of all building information for different phases of the project lifestyle in the form of a data repository" (Gu & London, 2010, p. 988). There is optimism within the Irish construction industry that new approaches such as IPD can offer innovation and efficiency. Mathews (2015) Advises that "the design and construction industry is multifaceted, it is people and process orientated and produces a product at the end of the day. It is ripe for the kind of transformation that digital can bring" (p. 34).

The concept that IPD along with BIM can bring a transformation to the Irish construction industry warrants further exploration and research. There is growing awareness among professionals that a multidisciplinary approach will strengthen results from a design, construction and facilities management perspective (McAuley, Hore, & Deeney, 2013). While there is an increasing acknowledgement among construction professionals that design must take place in a multidisciplinary environment (Arayici, Coates, Koskela,

Kagioglou, McCall, & O'Reilly, 2014), there is scant evidence of this being practically applied within the Irish construction industry. This is reinforced by Boylan (2015) who observes "As an industry, we have continued to do the same things, time and time again in how we approach major construction projects, the opportunities are out there to learn and improve our industry" (p. 14).

1.2 Context and Rationale.

The Irish construction industry has emerged from a deep recession, and is currently at a transitional stage, faced with reduced fees, higher client demands for that fee and increased responsibility (Kane, McAuley, Hore, & Fraser, 2015). There is widespread agreement among key stakeholders in the industry that we are exposed to unprecedented times in relation to technological and economic change (Buildcost, 2015). There is little doubt that the experiences encountered due to economic collapse have acted as a catalyst for major change (Burke-Kennedy, 2014). Construction professionals now realise that adoption of leaner work practices are fundamental to survival in an increasingly competitive market (Kane, McAuley, Hore, & Fraser, 2015). The recession forced many main contractors and construction professionals to source work overseas, specifically in the UK, where adaption of BIM and associated technologies is increasingly significant (RICS, 2014). This exposure has educated stakeholders to the benefits of BIM and associated processes. "To assist in the recovery of the construction industry here, the Forfas report (2013) stated that in order to maintain competitiveness, Irish construction firms must comply with evolving building/product regulations and exceed international industry standards with the use of BIM based integrated project management (Kane, McAuley, Hore, & Fraser, 2015, p. 120)."

Building Information Modelling is a new way of thinking with regard to the construction process. Collaboration is the cornerstone of this new way of thinking (Bouchlaghem D. , 2012). True collaboration within the construction industry requires a seismic shift from traditional systems, adversarial in nature, to effectively working on a common information source (Bouchlaghem D. , 2012). The ultimate goal of BIM adoption is to facilitate Integrated Project Delivery (IPD) on construction projects (Arayici, et al., 2014). IPD is a collaborative alliance of professionals, systems, business structures and practices into a process that harnesses the talents and insights of all participants, to optimise project results, increase value to the client, reduce waste, and maximise efficiency through all phases of design, fabrication, and construction (AIA, 2007). IPD is only at an embryonic stage in Ireland at present (McCauley, Hore, West, & Kehily, 2013); however the successful implementation of BIM to level 3 and higher has the potential to fundamentally change the way we construct projects in the future.

1.3 Aim of the Research and Research Objectives.

The overall aim of this thesis is ***to investigate whether Integrated Project Delivery is a viable procurement route for construction work within the Irish construction industry.***

Although this is the core aim guiding this research, it is necessary to identify a number of objectives which must be achieved in the process of achieving the overall aim.

My objectives are as follows:

- Outline current procurement routes being used in Ireland at present for construction projects.
- Define IPD (Integrated Project Delivery), An Irish perspective.
- Investigate the level of uptake with regards to IPD as a procurement route on construction projects in Ireland and barriers to its implementation.
- Propose guidelines and recommendations on proposed best practice in relation to main contractor selection for future IPD projects in the Irish construction industry

1.4 Justification.

The international construction industry has experienced substantial change over the past three decades with regard to technology, specifically in the areas of information technology and computerisation (Hore, O'Kelly, & Scully, 2009). The adaption of BIM and associated technologies have become widespread throughout the construction world (Alarcon, Christian, & Tommelein, 2011). Due to our proximity to the UK, and the tendency of many Irish contractors and professionals to work in that jurisdiction, exposure to BIM technologies and processes are increasing. The UK government have reinforced their commitment to development of BIM use by enacting the BIM mandate on public work contracts, "The UK government using experiences gained from other countries are driving through changes to the construction industry…The UK government has mandated that level 2 BIM be a requirement as a minimum by April 2016 on all major public projects, and level 3 by 2020 (Cunningham, McClements, & McKane, 2015, p. 22)". This innovative approach by the UK government has not been mirrored in this jurisdiction. There is little evidence of an appetite among main stakeholders in the Irish construction industry to embrace BIM technologies and IPD. This research will take stock of where the Irish construction industry is at with regard to facilitating BIM on future projects with a particular focus on IPD.

Fraser (2014) advises that Ireland is a small open economy which has a strong ICT sector, and concludes that the embracing of BIM processes will stimulate economic growth, while also enlightening the Irish government on the merits of BIM technologies. The holistic notion of collaboration among stakeholders has to be examined on the ground to measure milestones of progress in this area. This research acknowledges that IPD will only flourish in a BIM friendly construction sector, backed up by Kane et al. (2015) who observe that "BIM on its own was not the answer, but that a collaborative contractual environment will allow BIM to be used correctly to optimise benefits. BIM provides a more IPD friendly approach by its inherent nature (p. 122)".

1.4 Basis for Research Design.

The research design utilised in this thesis was structured in a step by step approach which is used by (Moustakos, 1994) a qualitative methodology via semi structured interviews. Crotty (1998) advises that theoretical perspective is a method of observing the world and making sense of it. It is important to establish the theoretical perspective from which research was conducted on this thesis. The research design is explored in detail in chapter 3, providing a detailed exploration of methods utilised and defence of those methods. It was imperative that the research design provided for participants who had existing knowledge of building information modelling and associated technologies due to contemporary nature of this research. The resultant choice of methodology was qualitative in nature. Gray (2006) observes that "the well conducted interview is a powerful tool for eliciting rich data on people's views and attitudes" (p213). The in-depth interviews have adapted a semi structured format aimed at exploring and resolving key issues by gathering rich and deep information

1.5 Summary of chapters

This thesis comprises of six chapters, intrinsically linked to provide the reader with a clear insight into how the aims and objectives are researched, and how overall conclusions are formed. The chapters are summarised as follows:

Chapter Two provides an in depth analysis of existing literature relating to integrated project delivery, and by association, building information modelling. This is a relatively new area from an Irish perspective with small amounts of current literature on this topic. The author has turned to international commentators where necessary to enhance this process. The literature review exposes gaps in available commentary relating to the aims and objectives outlined above, defending the necessity for primary research in this area

Chapter Three establishes the theoretical perspective behind the study, and provides a clear and concise background to the choice of methodology.

Chapter Four provides a commentary on the interviewing process, and the raw data arising from this process.

Chapter Five provides an in depth analysis and interpretation of the data collected. The data gathered in chapter four forms the basis for establishing reoccurring themes.

Chapter Six, the concluding chapter addresses the aims and objectives detailed in chapter one, and reflects on the research process in its entirety. It also reflects on areas where further research may be conducted in this area.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews existing literature surrounding; procurement of construction work, building information modelling and integrated project delivery within the parameters of the Irish Construction industry. This review will also refer to international literature on the above areas where there is a deficiency from an Irish perspective, drawing on international best practice for direction.

The current economic environment will act as a backdrop to this research. During the years 2002 to 2006, the economic state of the Irish Construction industry had experienced high growth and output (SCSI, 2011), however economic collapse became a reality in 2009 (Hannock, 2011). Green shuts of recovery began to appear in 2013 which led to relatively steady growth from 2014 onwards (SCSI, 2016). The construction companies and professionals who have endured challenging times during the downturn are more inclined to embrace leaner and more efficient methods and technologies (Kane, McAuley, Hore, & Fraser, 2015). This is reinforced by O'Halloran (2015), who observes that construction stakeholders must learn from their mistakes of the recent past and ensure that history does not repeat itself.

2.2 Procurement of construction work

Procurement can be defined as "the process of obtaining goods and services from another for some consideration (Hackett, Robinson, & Statham, 2009, p. 21)". In the modern construction industry this can prove to be a complicated procedure due to the large scope of projects and inherent complexities within the process. "The complexity arises from the need to comply with numerous regulations, involve professional consultants, achieve value for money, demonstrate accountability, regulate complicated contractual relationships and through all this achieve a timescale largely dictated by the client's specific business objectives (Hackett, Robinson, & Statham, 2009, p. 21)." This observation summarises a process which is fundamentally different to other industries, for example every site is different even for similar buildings with similar client expectations. The unique characteristics of each project results in a tailor made procurement route for every new project. The bespoke nature of each procurement process adds to an inherent complexity unique to the construction industry. Comparisons have been made between the construction industry and other industries such as the motor car industry (Latham, 1994), and the aerospace industry (Flanagan, 1999), which have been analysed by Ashworth (2010) who has determined that the following characteristics are absent from the construction industry which are inherent in the other industries studied: "

- Recognition of a manufacturing culture
- Integration of design with production.
- Importance of supply chain network
- Focus on innovation and the link with adequate research and development
- Standardisation in design, components and assembly across the product range"

(Ashworth, 2010, p. 227)

The deficiencies outlined above in Ashworth's analysis can be summarised as a lack of collaboration among the key stakeholders within the construction industry, resulting in an entrenched silo mentality. It could be argued that integrated project delivery is in essence a panacea for the deficiencies highlighted above by facilitating collaboration as the cornerstone of a more holistic procurement route.

The client base within the Irish construction industry can be divided into two main categories; public bodies / government departments which are funded from the public purse and private clients. The clients perspective with regards to procurement, whether private or public concentrate on what is known as the cost, quality and time paradigm (Hackett, Robinson, & Statham, 2009) which is based on the assumption that a client wants the delivery of a construction project constructed to the highest quality, delivered to the shortest programme possible, achieved at the lowest cost (Hackett, Robinson, & Statham, 2009). In reality however, a careful balance of these objectives is required, and if a client prioritises one objective, e.g. cost, this will be to the detriment of the other two objectives. E.g. quality and time (Ashworth, 2010). There are many procurement strategies available to perspective clients. Hackett et al (2009) advise that a key decision when determining what procurement strategy to adapt is dependent on the manner in which the detailed design is progressed. A traditional procurement route will facilitate the design team in developing the design while a design and build strategy will pass design responsibility over to the contractor. Ashworth (2010) advises that there are four main questions that a client must answer prior to choosing a procurement strategy;

1. Consultants or contractors?
2. Competition or negotiation?
3. Measurement or reimbursement?
4. Traditional or alternative procurement?

In essence, when a client is selecting either a consultant or contractor there must be some form of competition among competitors or a negotiation with a single organisation as an alternative (Ashworth, 2010). He notes that lack of competition drives up costs observing that anecdotal evidence suggests that negotiated tender prices result in an increase of 5% to initial building costs. This would amount to a

substantial additional cost on a construction project which most clients would be unwilling to suffer unless due to exceptional circumstances.

There are many reasons for the malfunction of a chosen procurement strategy such as; lack of flexibility due to overly prescriptive client briefs, unnecessarily high standards, delays in decision making, unwillingness to use standard products, substantial scope changes, poor communication in the supply chain, conflicting objectives, overlapping of professional services, conservative entrenched mind sets and late or inadequate design information (Hackett, Robinson, & Statham, 2009). Clients, both public and private have shown dissatisfaction with traditional procurement routes and are demanding change. This is reinforced by (Smyth & Pryke, 2008) who advise "numerous reports have identified both public and private sector clients dissatisfaction with the traditional approach within the industry (p. 42)". The overall research question embedded within this study surrounds the investigation of integrated project delivery as a viable alternative procurement route within an Irish context, focussing on the very areas which are weak within more traditional procurement strategies.

2.3 Procurement within the Irish Construction Industry

The Irish construction industry is undergoing a period of unprecedented economic change. This is highlighted by economic data presented by the Society of Chartered Surveyors Ireland in their annual appraisal of the industry. "A sustainable construction sector is a key element of any properly functioning economy and following several years of declines in output, the construction sector finally began to stabilise in 2013 and grew from 9.9% in 2014 to €11 billion. Since the industry bottomed out in 2012, the overall volume of output is projected to be almost 42 per cent higher by 2016 (SCSI, 2015, p. 2)", and there is further optimism in their outlook for future developments; "as the economic recovery gathers momentum and becomes more widespread and as development becomes more viable, the pace of expansion in construction output is expected to accelerate further (SCSI, 2015, p. 37)". This is reinforced by (Buildcost, 2015), who advise that construction tender rates have increased by 5.5% during 2015 and that tender indices suggest that the phenomenon of below cost tendering has not prevailed during 2015. The president of the Society of Chartered Surveyors Ireland, Andrew Nugent has echoed these sentiments with his observation "following one of the most difficult periods this country and our industry has ever witnessed, we are now entering 2016 with an increased sense of optimism and renewed energy to tackle the many challenges ahead (Nugent, 2016)". This positive commentary supported by strong statistics place the Irish construction industry in a better space, not experienced since 2008. It also acts as a backdrop to this research. "There is a renewed optimism among contractors and professionals who were forced over the past seven years to operate with very lean overheads, breakeven margins and in some

cases operating on a below cost basis (Kane, McAuley, Hore, & Fraser, 2015, p. 118)". This optimism is supplemented by a desire not to repeat the mistakes of the past and embrace ideas and technologies that can enhance a leaner approach going forward.

This economic environment has had a major influence on the procurement of construction work from both private sector and public sector clients. During the recession Scully, Caeleton and Quinn (2011) advised that the construction industry was in challenging times. They advised that by 2011, the construction industry was faced with the completion of most major construction projects, with no significant replacements in sight, coupled with further cutbacks in government capital expenditure, delays in NAMA funded projects, and very little private sector activity. In fact the government was the main client during this period with the flow of private sector investment in construction reduced to a trickle (Scully, Caeleton, & Quinn, 2011). Hence procurement during the darkest days of the recession was mainly public procurement.

Another feature of procurement during this period was the prevalence of below cost tendering (Lynch, 2011), where up to 50% of returned tenders during 2011 estimated to be below cost. This may appear at first glance to be of major advantage to the client from a cost viewpoint, however questions were asked relating to quality and end product. This is summed up by the then president of the SCSI, John Curtin, who observed "This race-to-the-bottom poses a real threat that tenders will not provide the required standard of construction quality and professional expertise needed for the long-term viability and return on investment of any project over its life cycle (Lynch, 2011)".

The Department of public expenditure and reform have overall responsibility for implementing national policy in Ireland in relation to construction procurement. They provide through the "Capital Works Management Framework" the necessary policies and contracts for procurement of publicly funded work in this country (Dep of P.E, 2016). They embarked on a major reform of public procurement policy for construction projects in 2004, mainly due to political concerns with regards to cost overruns on publicly funded projects (Dep of P.E, 2016). Their aim at that time was to concentrate on three main areas:

- Cost certainty at tender stage
- Better value for money
- More efficient delivery of public works projects

(Dep of P.E, 2016)

This reform resulted in the Public Works Contracts (PWC) suite of contracts being introduced in Ireland in 2007 (Kane, McAuley, Hore, & Fraser, 2015). This extensive range of contracts catered for all government procurement in relation to construction, **"As at June 2014, there had been 14 iterations of the Standard Conditions of Engagement (as well as the introduction of further forms for specific projects and services), and 9 iterations of the principal forms of building contract (Molloy, 2015, p. 1) ".** These contracts were widely criticised by main contractors and consultants alike who felt that the burden of risk was unfairly balanced in favour of the employer, resulting in numerous disputes and acting as a barrier to economic recovery within the Irish construction industry (Kane, McAuley, Hore, & Fraser, 2015). A key aspect of the new contracts was that quality tender documents at tender stage would provide cost certainty for the employer. In reality however due to the economic recession, consultants now operating on reduced fees, were not providing the quality tender documentation anticipated. This resulted in increased disputes between parties and poor relationships between stakeholders**. "What resulted was an unhappy industry, on all sides: professionals and contractors considered they were being asked to foot the bill, unfairly, for risks, which whilst contractually theirs, were not ones that they could properly manage, and contracting authorities and their project teams, faced with endless claims and disputes, which necessarily had to be pursued by contractors. (Molloy, 2015, p. 1)".** This resulted in the Irish government instigating a major review of procurement policy in 2015 with the view of making any necessary changes to the public works contracts to ensure fair and reasonable terms for all parties involved (Kane, McAuley, Hore, & Fraser, 2015)

An interesting aspect of the 2004 review was the complete absence of any reference to building information modelling or integrated project delivery as a possible process or even an aspiration. It is clear that even though government policy was directly linked to greater efficiencies, these options were not on the radar at that time (Dep of P.E, 2016). According to Kane et al (2015) a recent government report known as the Forfas Report has provided a new government interest in collaborative technologies. Forfas are a government advisory board for enterprise, trade, science, technology and innovation. Their report has recommended the implementation of changes necessary to facilitate a more collaborative and co-operative approach among industry stakeholders. The report advises that for companies within the Irish construction industry to maintain competitiveness, they must embrace BIM technologies and ultimately IPD, and pay close attention to evolving international standards (NBC, 2016).

"In order for BIM to become a reality, the Irish Government must become the main driver in this process and, review current BIM initiatives and barriers in public sector procurement bodies in other international countries (Deeney, Hore, & McAuley, 2013, p. 21)". This quotation highlights the absence of a government mandate for BIM adaptation in this jurisdiction which now prevails in the UK, and while

sentiment towards these technologies is now appearing in government reports the absence of a compulsory mandate results in no real pressure to embrace this process. Kane et al (2015) are quite clear on where government policy has to go before tangible progress can be made in this area, “they should take a strong position, just like they have taken in the UK, which would be immensely beneficial to our economy and to the companies who compete in international markets kane et al (2015, p. 121)”.

With regard to private sector investment in the Irish construction industry, there is room for optimism after a number of weak years from an investment viewpoint, “after a period of gloom and despondency, it is heartening to see the pickup in activity in the construction sector and real optimism about a brighter, more measured future (O'Higgins & Mahony, 2015, p. 5)”. Procurement in this sector, having collapsed during the recession years (Hannock, 2011), has reignited during the recovery period from 2014 onwards, which has been reflected in the latest tender price indices (SCSI, 2016). This sector of the industry has traditionally utilised the RIAI standard forms of contract which are less contentious than their public works counterparts, and more recently bespoke contracts are increasing in usage Cunningham et al (2015).

The choice of procurement route utilised by the private sector in Ireland varies from traditional, design and build to management contracting which has become a feature of multinational investment, especially in the pharmaceutical area. The director of the Construction Industry Federation, Tom Parlon observed in 2012 that ““Foreign direct investment has been one of the few sources of optimism to the construction industry at a time when there has been little activity and high levels of unemployment in the sector, the jobs and economic impact generated by these new projects will be a shot in the arm to the industry and we hope to see further investment in the months and years ahead (Percival, 2012, p. 1)”. The influence of multinational activity has strengthened the knowledge base in Ireland with regard to BIM technologies and processes, and this international influence is at its strongest among Irish construction companies who operate on an international stage. Companies such as: BAM, J Sisk & Co. and Pj Hegartys are examples of construction companies who are drawing on international experience when advising on BIM utilisation**. “BAM Contractors and others who are striving to utilise BIM across all of their projects, both at home and abroad. BIM is a new technology in an industry that’s typically slow to adopt change, but this change is happening and there’s no doubt that BIM will play a crucial future role in building design and documentation (Maguire, 2014)”.** Deeney et al (2013) reinforce the importance of international influence when he observes that in order to understand if BIM can help the Irish construction industry, it is imperative that an investigation should take place into the performance of BIM in other international countries. If the Irish construction industry were to adapt and embrace BIM, it is

imperative that we as an industry have examined the transition to BIM experienced by these countries, in order to assess whether we can also adopt their approach and migrate to BIM with minimal disruption.

For BIM and IPD to be truly embraced by private sector clients in Ireland, awareness of true value must be a priority. Wallwork (2015) feels that the real value of BIM surrounds the enriched data attributes for all maintainable building components in the model, and the way this helps clients to make the correct decisions not just during the construction phase, but across the full lifecycle of the asset. She also contends that potentially the largest savings may become apparent post construction and during the lifelong maintenance of the asset (Wallwork, 2015).

2.4 Collaboration in Construction.

There is generally consensus among construction professionals and stakeholders that new and innovative ways of working must be embraced in order to remain competitive in a global market and meet the requirements of ever demanding clients (Bouchlaghem,2012). Industry can learn from experiences in educational institutions; Vygotsky (1978) advises that students are capable of performing at higher intellectual levels when asked to work in collaborative situations. Bouchlaghem (2012) further advises that effective collaborative working is essential if design and construction teams are to consider the project lifecycle, and not just the initial building cost. They must also consider the production, maintenance and decommissioning process. Despite the obvious teamwork required to complete a construction project from start to finish, the industry has traditionally been hampered by adversarial relationships. Smyth & Pryke (2008) observe that "construction has been identified as a complex systems industry, where organising by projects, temporary coalitions of firms and a heavy client involvement are the norm (p. 78)". They further advise that construction companies use "coping strategies" to manage this uncertainty and complexity, however in many cases resulting in adversarial relationships (Smyth & Pryke, 2008).

The key concept of collaboration can be defined as "the collective work of individuals and groups undertaken with a sense of common purpose and direction within a shared environment that combines physical, digital and virtual resources (Bouchlaghem D. , 2012, p. 6)".The number of different professionals required to deliver a construction project will always demand a certain level of collaboration, however the problem has generally been the nature of this collaboration, and the lack there of in certain areas. The construction industry can be characterised as unique in comparison to other industries regarding the sheer number of different professionals and stakeholders required to deliver a construction project. "The multidisciplinary nature of the construction industry with its often bespoke and transient projects makes the nature of and need for collaborative working different from other fields

(Bouchlaghem D. , 2012, p. 6)". This reinforces the fact that construction projects rely on collaborative working among a disparate selection of construction professionals, working together for a relatively short period to design and construct a project (Bouchlaghem D. , 2012).

2.5 Lean Construction & IPD

Within the BIM spectrum, there is a strong link between the concept of lean construction and integrated project delivery. (Liker, 2004) provides an extensive history of lean production within the car industry which has formed the basis of lean thinking in many manufacturing industries. (Liker, 2004) observes that the formation of the Toyota Production System (TPS) could be considered as one of the most important milestones in the history of lean production. This is reinforced by (Comiskey, McLernon, Fleming, & Harty, 2015) who observe " The TPS essentially focused on four main areas in its pursuit of lean, waste reduction was key, but it sat alongside the ethos of having an overall philosophy and focussing on people and partners and problem solving" (p. 239). The construction industry however is fundamentally different to other industries due to the bespoke nature of every project with unique site conditions (Ebbs, 2015). This has presented problems when trying to implement a lean approach as this unique nature throws up different problems and variations on every project. (Ebbs, 2015) is in no doubt that traditional procurement systems are complex and can result in the waste of millions of euros on large scale projects. With acknowledgement that this amount of waste is not acceptable in any industry in the twenty first century, there is an appetite for procurement routes, while initially more costly up front, can far outweigh this initial burden with substantial savings to the project as a whole (Casey, 2015).

(Casey, 2015) sums up the concept of lean production on construction projects in simple terms as "a particular way of structuring and managing a project that reduces waste while increasing quality and value for the customer" (Casey, 2015, p. 41). He also observes that a lean approach empowers all of the company employees to offer opinions and ideas fostering a sense of cooperation. This ultimately produces cost savings, maximises efficiency and enhances quality. Comiskey et al (2015) advise that publications of the Latham report in 1994 and the Egan report in 1998 were the catalyst for true lean thinking in the UK construction industry, which bore a close resemblance to the TPS. Comiskey et al (2015, p. 239) make the vital link between the drivers for lean "all construction professionals will require an in-depth understanding of BIM working methods, an appreciation of the ethos of collaborative and lean working and confidence in applying such methods and processes in practice".

The link between lean construction, building information modelling and integrated project delivery are undisputable. To a certain extent true IPD requires all three components as illustrated in figure 2.1

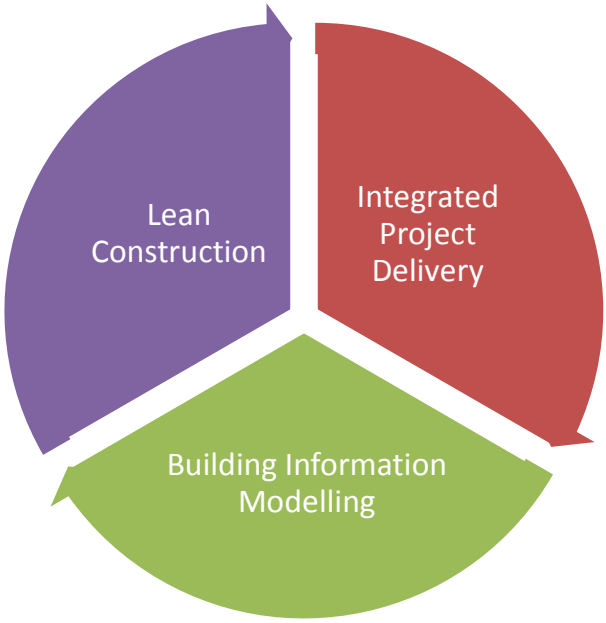


Figure 2.1

(Ebbs, 2015) advises that for true innovation to exist on a construction project, finance must be able to cross contractual boundaries, and while this is not possible under traditional procurement methods, it is made easier utilising integrated project delivery options. At present, there are no standard forms of construction contract in Ireland that facilitates an IPD relationship, and this should be a government priority when dealing with the Irish construction industry (McCauley, Hore, West, & Kehily, 2013)

Boylan (2015) advises that clients in the Irish construction industry are no longer satisfied with re-using the same old procedures with little changes to wastage costs and schedule delays. "There must be process improvements that lead to more cost and time effective solutions without impacting on safety or quality in design and construction…lean and IPD are two examples of how efficiencies and best practice from other industries can be transferred to the construction sector" (Boylan, 2015, p. 15).

2.6 The link between BIM and IPD

Integrated Project Delivery is a contemporary and innovative procurement route for the delivery of construction projects (Bouchlaghem D. , 2012). Building Information Modelling provides the system to facilitate this procurement route which provides for meaningful collaboration between construction professionals (AIA, 2007). "The AEC industry has realised the value that can be generated through collaboration and integration….the results of these ongoing efforts are integrated project delivery, building

information modelling and lean (Pishdad-Bozorgi, Hamzanlui-Moghaddam, & Karasulu, 2013, p. 1)", and while this may be the case on the international stage, the conservative nature of the Irish construction industry has not been conducive to advances in this area. (Ebbs, 2015)

There is nothing new in the concept that increased collaboration among key stakeholders on a construction project will achieve better results, which is advised by (Laufer, Denker, & Shenhar, 1996) in their observation "Simultaneous management can be summed up in one breath: by planning systematically, making early adequate decisions, involving all parties concerned early, leading them as a team, operating first rate communications, using simple procedures, executing the projects phases early and in parallel, monitoring project performance and the environment, and judiciously adapting the projects execution to arising contingencies – one can execute challenging projects with excellence and speed (Laufer, Denker, & Shenhar, 1996, p. 198)". This statement is twenty years old, yet offers an early glimpse at the principles behind building information modelling, and integrated project delivery.

The term link almost understates the relationship between these two concepts, and a more realistic statement would be that IPD is inherent within the BIM process, or to take this a further step, a project must utilise IPD to truly embrace BIM. This study has already established through literature that there is not one concrete definition of what BIM really is, with various views. However the weight of argument appears to have settled on the concept that BIM is a process. "There are many misconceptions that BIM is just some type of fancy 3D modelling software, however it is not, BIM is a process, a process that can bring efficiencies to businesses in order to deliver projects quickly, competently and reliably for clients" (Tier BIM Consults, 2015). This statement summarises the views of many experts in this field. This is reinforced by Eastman et al (2011) who observe "BIM is not just a modelling technology, but an associated set of procedures which have communication and information management at its core" (p. 13). Smith (2014) has the same world view on this issue where he observes that BIM is a completely different way of thinking rather than just a technological innovation, requiring a change in culture within the industry

To fully understand the links between BIM and IPD, we must also explore the different levels of BIM as outlined by (BSL, 2014);

- Level 0; No real collaboration between construction professional on project.
- Level 1; No real collaboration between disciplines, however of 3D CAD and use of 3d models for visualisation
- Level 2; Collaborative working between disciplines, parties own their own 3D models and are not necessarily working on the same model

- Level 3; Full collaboration between all disciplines by use of a shared project model, working in the cloud accessing and developing the same model
- Level 4; Time – Programming and scheduling added to the model
- Level 5; Cost – Cost data immersed in the model / Cost Control
- Level 6; Facilities Management- Model developed for post construction period

As the levels increase, the amount of collaboration between disciplines becomes stronger, and the requirement for an integrated project delivery approach becomes vital. Eastman et al (2011) advise that each discipline must align interests to facilitate BIM, along with a procurement route that is sympathetic to true collaboration, that route is Integrated Project Delivery. The levels of BIM implementation above stops at level 6, however some commentators talk about future infinite levels of BIM (Aouad, Lee, & Wu, 2005) using the term '(Nd) to describe the BIM process which will be inclusive of the wider spectrum of aspects in the construction industry. Examples of this include; buildability, sustainable construction, energy loss, etc. (Fu, Kaya, Kagioglou, & Aouad, 2007)

There is growing evidence that for BIM to develop to its maximum potential, there must be a procurement route which is collaborative, innovative and flexible (Eastman, Teicholz, Sacks, & Liston, 2011). A procurement route that offers the contractual freedom to provide for cross discipline interaction and responsibility (Smith, 2014). The procurement route most suitable for this development is IPD (Boylan, 2015).

2.7 IPD – The Irish perspective

SCSI (2016) advise that the value of output in the Irish construction industry recovered to an output of €11 billion in 2015, circa 6.9% GNP, in comparison to €9.1 billion in 2012 which shows an upward trajectory. As a relatively small nation on the world stage, our industries have traditionally been influenced by our historical and cultural links to USA and to a greater extent UK (Roper, 1997). Many Irish construction companies are working on both sides of the Irish Sea, and are influenced by the UK construction industry (McAuley, Hore, & West, 2012). They also point to the important role which the Irish government must play for BIM and IPD to take hold in Ireland in a meaningful way. They look to the UK government mandate on BIM and advise that a similar environment must be present in Ireland in order for Irish companies to abandon their silo mentality and embrace collaboration (McAuley, Hore, & West, 2012). This sentiment is shared by Maguire (2014) who feels that it is inevitable that Ireland will follow the UK lead and introduce a mandate.

Forfas, the Irish government advisory board, an enterprise, trade, science, technology and innovation, have provided narrative on BIM implementation in Ireland in their 2013 report. They propose to work with Irish construction firms to develop the required educational and technical skills necessary so they can compete in markets where BIM is required (Forfas, 2013). There is recognition within the report that Irish construction companies have been slow to embrace new BIM technologies. They also express concern that this slow take up could put Irish companies at a competitive disadvantage when competing with international firms (Forfas, 2013). This is enhanced by Kane et al (2015) who feel that BIM adaption within the construction sector will stimulate the Irish economy, however warn that strong leadership at government level is fundamental to BIM and IPD adaption. "The benefits are clear, but for the adaption of BIM in Ireland to move on, the process needs leadership…it is difficult for the government to promote BIM and prioritise a sector which is still seen as one of the main culprits of the economy's demise" (Kane, McAuley, Hore, & Fraser, 2015, p. 120).

2.8 Challenges relating to IPD implementation.

There are challenges to the adaption of BIM and IPD technologies and processes in the Irish construction industry. There is a common theme running through the literature on the need for cultural change and the requirement for a change to work practices (Smith, 2014). The Irish construction industry is conservative by nature (Boylan, 2015), and the level of change outlined in this study is a huge undertaking. Irish construction firms have become accustomed to carrying out business in a manner that has evolved over decades, and there is an obvious challenge in changing that culture.

The questions surrounding contractual issues and ownership will pose a substantial problem going forward, and who has responsibility for what? Redmond et al (2011) are concerned that questions may be posed on who takes responsibility for the total quality of deign contained within the 3d model. There appears to be a collective responsibility, however that may pose legal complications such as professional indemnity insurance issues (Arensman & Ozbek, 2012). This can result in a reluctance on the part of construction professionals to engage in this process where grey areas exist. Eastman et al (2011) go further and advise that governments need to develop guidelines on copyright laws relating to BIM models going forward.

The implementation of BIM / IPD technologies within any given company gives rise to software issues. BIM models by their nature are very large in size and demand high tech hardware and software from an IT perspective, this can pose problems for companies who are not equipped to deal with these models (Cheung, Rihan, Tah, Duce, & Kurul, 2012). There may also be a reluctance in some quarters to invest company finances in upgrading technology when there is an unknown element to future use within an organisation (Azhar, Hein, & Sketo, 2008)

Introducing new software and technology presents the obvious problem of educating and training staff on how to operate new systems. There is little point in having the necessary infrastructure in place within a company if employees are unable to use that infrastructure (Cheung, Rihan, Tah, Duce, & Kurul, 2012). This poses the problem of additional training costs for companies who are trying to embrace new BIM technologies

2.9 Summary

Although the literature surrounding BIM and IPD technologies and processes is extensive from an international viewpoint, there is a deficiency dealing with the Irish perspective. This is not surprising due to the fact that these processes are relatively new to the Irish construction industry. The pace of change within that industry has been stunted by a deep economic depression between 2009 and 2014 with gradual improvement since then. This economic reality along with the conservatism inherent in the industry has not been conducive to BIM adaption and implementation.

This chapter has addressed the aims and objectives of the study by carefully reviewing existing literature, both Irish and international on the key focus areas. The key focus areas being; procurement, collaboration, BIM, IPD and the links between these areas. The literature review has found that these links are so strong to suggest an interdependency exists between them which must be fostered for full BIM implementation.

The literature review has exposed the gap in the body of knowledge surrounding the use of IPD as a viable procurement route in the Irish construction industry. This legitimises the requirement for quality research in this area. This research is further explored using a methodology defended in chapter 3, and presented in chapters;4,5 and 6 where the views and opinions of experts in this field are gathered and analysed in order to answer the research question posed.

CHAPTER THREE

THE RESEARCH DESIGN

3.1 Introduction

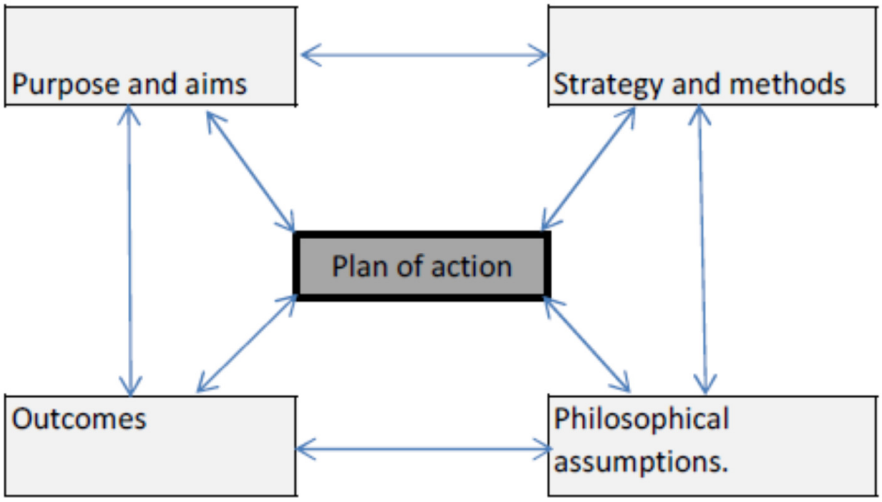
The research design for a study of this nature provides the blueprint for establishing a strong methodology (Crotty, 1998). There is an onus on the author to clarify the theoretical perspective adapted when designing that methodology, and poor preparation in this area can result in the study ending in disarray later on (Robson, 2002). When designing that methodology, it is important to pay careful attention to the aims and objectives outlined in chapter one. It is also important to defend the chosen methodology, and clearly explain why other available methodologies are not suitable for this thesis. Denscombe (2010) uses the analogy of foundations on a building, and the idea that inadequate foundations will result in eventual building failure no matter how well the building superstructure is completed. (Denscombe, 2010) advises that "philosophical assumptions constitute the foundations for research in the way that';

- They underpin the perspective that is adopted on the research topic.
- They shape the nature of the investigation, its methods and the questions that are asked.
- They specify what type of things qualifies as worthwhile evidence.
- They point to the kind of conclusions that can, and cannot, be drawn on the basis of the investigation." (Denscombe, 2010, p. 117)

.Coming from a background in construction, the author can relate to this analogy, which is reinforced by (Crotty, 1998) who refers to scaffolding on a construction project and the use there off as a support structure when completing the project, similar to the way the research design supports the study in its entirety.

This study has adapted Denscombes idea of a plan of action which feeds directly into the research design. The central objective is the plan of action as illustrated in figure 3.1, which is intrinsically linked to the aims and objectives in chapter one, the philosophical theory which informs the chosen methodology, and finally the resulting outcomes arising from the process. This feeds into the narrative above reinforcing the requirement for careful planning at the outset. The overall success of the study will hinge on the quality of methodology which is adapted, therefore the methodology must be considered carefully with chosen applications analysed and defended.

Figure 3.1. Research Design



Research design: linking the parts together.(Denscombe 2010, p100)

3.2

Philosophical Assumptions

When establishing a credible methodology, (Crotty, 1998) advises on the importance of adapting an epistemological stance, and defines epistemology as being "concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate (Crotty, 1998, p. 8)". This study explores the views gathered from a selection of construction professionals, currently active in the Irish construction industry who have a working knowledge of BIM technologies (Stewart, 2014). Building information modelling and integrated project delivery are relatively new concepts in the Irish construction industry, hence many construction professionals have only basic knowledge surrounding this area and would not be equipped to make meaningful contributions to this study. When choosing a modus operandi to conduct the research, the author felt that it was imperative that a selection of construction professionals must be chosen who at the very least have a working knowledge of BIM technologies.

The three main research paradigms outlined by (Creswell, 2007) include; quantitative, qualitative and mixed methods. (Bryman, 2012) provides an analysis of these paradigms in table 3.3 summarising the main differences between the two approaches. (Naoum, 1998) provides us with definitions of these paradigms. He defines quantitative research as "an inquiry into a social or human problem, based on testing a hypothesis or a theory composed of variables, measured with numbers, and analysed with statistical procedures in order to determine whether the hypothesis or the theory hold true" (Naoum, 1998, p. 38). He advises that

qualitative research is "subjective in nature, it emphasises meanings, experiences (verbally in many cases), description and so on" (Naoum, 1998, p. 40). Due to the relatively new concepts being explored in this study, the number of participants with working knowledge of the area was limited. This ensured that a qualitative approach was necessary where quality data could be gathered from a handpicked selection who were conversant with the subject matter.

Table 3.1. Research Paradigms

		Quantitative.	Qualitative.
1.	Role	Fact finding based on evidence or records	Attitude measurement based on opinions, views and perceptions measurement.
2.	Relationship between researcher and subject.	Distant.	Close.
3.	Scope of findings.	Nomothetic	Idiographic
4.	Relationship between theory/ concepts and research,	Testing / confirmation	Emergent / development
5.	Nature of data	Hard and reliable	Rich and deep.

(Bryman 1998).

The above table illustrates how the researcher is guided when trying to choose an appropriate paradigm going forward. In this particular study, opinions and views from appropriate professionals were imperative to a successful outcome. The technologies in question are emerging in the Irish construction industry and certainly at the development stage. Also the data being collected was from a relatively small sample of professionals within the Irish construction industry, and had to be "rich and deep" to provide for in depth analysis and meaningful conclusions. This lends itself to Naoum's definition of qualitative above with an emphasis on; subjective in nature, experiences, often verbal in nature.

3.3 Phenomenology

When preparing the research design, and deciding that qualitative research was the suitable paradigm for this study, the choice of strategy within the qualitative area was a critical component. As advised above, the participants had to be working in the BIM field to make meaningful contributions. In fact if their careers were immersed in the BIM area, the richness of data arising would enhance the research process culminating in strong conclusions. Phenomenology is a form of qualitative research which focuses on people's lived experience of a defined phenomenon (Creswell, 2007). Within this type of research there is an emphasis on

commonalities among participant views on a particular research question where these participants are drawing from experience within their working life.

The phenomenon being explored in this study is building information modelling with a particular emphasis on integrated project delivery. All participants will have experienced working on projects utilising building information modelling informing their views on the possibilities of integrated project delivery. Experience is the vital component in this study due to the lack there off of this field within the Irish construction industry. Merriam (2002) places a large emphasis on describing the essence of any particular phenomenon, and getting to the heart of that essence

3.4 Methodology.

The importance of a strong methodology is paramount to achieving a successful conclusion to the study. The methodology is intrinsically linked to the chosen research paradigm which in this case is qualitative. Methodology can be defined as "the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and the use of methods to the desired outcomes" (Crotty, 1998, p. 3). Opie (2004) observes that this is a system amounting to selection of the best approach required to gather evidence in order to meet the aims and objectives of a given study. "A method offers a systematic way of accomplishing something orderly or disciplined, with care or rigor" (Moustakos, 1994, p. 104). This thesis has utilised a phenomenological qualitative research methodology with semi structured interviews as the platform for gathering data.

This study has utilised the stepped approach designed by (Moustakos, 1994) with modifications necessary for this research study. This is illustrated in Figure 3.2, and develops a "road map" for the thesis from choosing the research topic, to acquiring data, through to final conclusions

Figure 3.2. Methodology Steps

Step 1; As a practicing Quantity Surveyor in the construction industry for over twenty years, the author has extensive experience in the area of procurement within the Irish construction industry. Linking this experience to the development of BIM in Ireland, along with the emerging procurement route which is integrated project delivery, presented the opportunity for much needed research in this area. A thesis proposal, containing the overall aim; to investigate whether Integrated Project Delivery is a viable procurement route for construction work within the Irish construction industry, was submitted and approved.

Step 2; Ethical considerations are always a major part of any research study. All research should be based on "a sense of pedagogic good" (Van Manen, 1997, p. 6) . As part of the process utilised by University of Salford when conducting research, a submission was made by the author seeking ethical approval. The nature of this study is not particularly sensitive in nature, and type 2 approval was granted by the university, see Appendix 1. All participants were briefed with appropriate documentation before interviews were conducted. The participants were content to not remain anonymous, and there were no real issues of concern relating to confidentiality.

Step 3; A detailed literature review was compiled in chapter two, which provides a detailed review of journal articles, books and other contemporary literature dealing with this field. Due to the contemporary

nature of BIM and IPD, there is a limited amount of literature dealing with this field of study from an Irish perspective, reinforcing the requirement for research in this area.

Step 4; The selection of participants to take part on this research study was dependant on selected participants having existing experience in the area of building information modelling. Moustakos (1994) advises that there are no prescriptive rules when selecting a participant group or number of participants necessary. However the author must bear in mind that the sample selected must be sufficient to establish credible findings and associated conclusions. The evidence gathered during the interview process must be sufficiently rich to resolve the research questions posed. Hence the calibre of participant will feed directly into the quality of data obtained.

Firstly, the number of participants had to be sufficient to garner a wide range of perspectives across a number of professional areas, yet not too unwieldly to make the process overly cumbersome. The time constraints within the study were also acknowledged, with each interview conducted taking on average of two hours. The number of participants was refined to eight construction professionals, the breakdown illustrated in table 3.2

Table 3.2 Participant Numbers

Participants	Numbers selected for interview.
Quantity Surveyor	2
Architect	2
Contractor	2
Construction advisory group	1
Academic	1

The breakdown in table 3.2 shows the diversity of participants, yet all have a major part to play in the emergence of IPD as an innovative procurement route. The rationale for selection of each profession is further explored in table 3.3 below

Table 3.3 Participant Rationale

Participants	Reason for selection
Quantity Surveyor	The quantity surveying profession play a major role in procurement on construction projects in Ireland. Their contribution is vital to understanding the state of play as it now stands in this area.
Architect	The architect is traditionally the head of the design team on construction projects, and is involved from project inception to final account.
Contractor	Contractors are integral to the construction process and throughout.
Construction advisory group	The construction advisory group in question are the fore runner in publicising the benefits of BIM and IPD in Ireland.
Academic	With any innovative technology, education of future professional in this area is a vital component

Once the intended sample size and nature of participant was decided, the actual participants themselves became the next milestone. The reasoning behind candidate selection and the importance of having experience in this area, has been well documented above. The participants were interested in taking part in the research and making a contribution to the body of knowledge surrounding BIM and IPD. The breakdown of participating companies is included in table 3.4. The rationale used for selecting participants is consistent with the research design and methodology outlined in this chapter. Each candidate was fully briefed on the subject matter of the study before taking part. Documentation used to obtain ethical approval from the University of Salford was used prior to conducting interviews, hence every candidate knew what to expect with regard to subject matter, use of data and subsequent storage of data after the interview process was complete. Table 3.4 further clarifies the importance of each role already outlined in table 3.3, providing the company name and nature of business. Each participant will be referred to as participant 1 to 8 in chapters; 4, 5 and 6.

Table 3.4 Participants

Participants	Rationale.
Main Contractors (X2) Director level.	The two participants from the main contracting area are highly experienced professionals with over thirty years' experience in the Irish construction industry. Both contracting organisations are placed in the top ten Irish contractors from a turnover viewpoint. Both companies are involved in some of the largest construction projects taking place in Ireland at present. They have extensive experience of BIM technologies and their application on live projects. **PARTICIPANT 1** **PARTICIPANT 2**
Architects (X2) Director level	Traditionally in Ireland, architects have taken the leadership role on construction projects. They are usually involved with any given project from inception stage and are the driving force through to final account. The two participants in question here have founded their own successful practices and are advocates of BIM use. **PARTICIPANT 3** **PARTICIPANT 4**
Quantity Surveyors – PQS (X2) Director level	The representatives from the quantity surveying profession come from two large established practices in the Dublin area. Both participants are at director level with extensive experience in the area of BIM. They both have completed projects where BIM was utilised at various levels. **PARTICIPANT 5** **PARTICIPANT 6**
Academic DIT	The academic in question has over twenty years' experience in the construction industry, ten of which lecturing in the built environment at Dublin Institute of Technology. He has recently completed a PhD in the BIM field. **PARTICIPANT 7**
Director CITA	CITA (Construction IT Alliance) is a federation of construction professionals promoting the use of ICT in construction. They are funded by members along with grant funding from government agencies. **PARTICIPANT 8**

Step 5; Interviews were chosen as the most appropriate medium for gathering data during the data gathering phase of the study. Naoum (1998) advises that "interviews can take three forms: unstructured, structured and semi structured" Where interviews are not structured, they do not require a set order or wording of questions. They are generally utilised when the researcher has a limited knowledge of the subject matter of their thesis. In this study, a structured approach was necessary

It was important to put structure on the interview by having a prepared set of questions which formed the basis of the interview. This semi structured approach provided an agenda for the interview without being over prescriptive on what could be discussed. Gillham (2000) stresses the importance of not letting the interview to develop into a conversation with no structure which will result in a meandering dialogue which is difficult to analyse. The main advantage of interviews is that they provide the perfect platform to accumulate expert opinion, of the quality required to address the aims and objectives listed in chapter 1. This approach facilitates the gathering of rich and deep quality data which Bryman (1998) advocates in his opinion on good qualitative research.

The set of questions were carefully prepared to draw out the information necessary to address the aims of the study. A pilot interview was conducted with a colleague who had extensive experience in the area of BIM as a pilot interview. Sampson (2004) advises on the importance of conducting pilot tests prior to commencing and discusses the disadvantages of "entering the field blind" and observes "In carrying out the pilot study I found that I learned some things that I had not anticipated and, in the way of all things, found that it was harder than I expected to learn about the things that initially seemed the most obvious and least problematic" (Sampson, 2004, p. 393). The author concurs with this summation and found the pilot interview a useful mechanism for fine tuning the questions and ensuring that the intended interviews would capture the required data.

Step 6; The interviews were arranged for times and dates agreed beforehand with selected participants. The sample of participants in question were all operating at a senior level within their organisations and hence time was at a premium. The semi structured nature of the interviews ensured that the time allocated for each interview was used wisely. The data was transcribed by hand as a record of the proceedings. The interviews were rigorous which is a fundamental requirement of the phenomenological approach (Moustakos, 1994). This is reinforced by Creswell (2007) who alludes to the necessity of an in depth process when conducting interviews of this nature.

Step 7; The final and probably most important step in the process was organising and analysing the data collected. Moustakos (1994) advises on the importance of developing a framework to reveal essences within the data. Creswell (2007) notes that significant statements must be identified within the data and key themes must be abstracted in order to formulate a coherent analysis of what has been collected. This study has concentrated on eight key themes which have derived from the data collected. This was conducted using the approach outlined by (Moustakos, 1994). "The understanding of meaningful concrete relations implicit in the original description of experience in the context of a particular situation is the primary target of phenomenological knowledge" (Moustakos, 1994, p. 14). The basis for evaluation and interpretation of data collected during the research process is based on Giorgi's five point approach to data analysis cited in Moustakas (1994):

1. "Read the entire description of the learning situation straight through to get a sense of the whole.
2. Develop a series of meaning units or constituents.
3. Eliminate redundancies – elaborate the meaning of constituents.
4. Reflection – researcher comes up with the essence of the situation.
5. Synthesises and integrates the insights achieved into a consistent description of the structure of learning."

A substantial amount of data was accumulated during the interviewing process. The five point approach equipped the author with a strategy for scanning the transcribed data and formulating key themes. The semi structured questions which formed the basis or agenda for each interview gave a certain level of organisation to the material gathered. Significant statements were isolated from the bank of material and these formed the foundations for constructing the main themes. Using this strategy, irrelevant and surplus data were isolated and removed

Moustakos (1994) discusses the interpretation of collected data and the importance of deriving overriding themes which will form the basis for analysis and subsequent conclusions. The overall goal inherent in the interviewing process was to collect rich, concise and innovative material, eliminating extraneous material, ultimately providing the armoury necessary to tackle the research questions posed. This study has produced eight key themes elicited from the collected data, and these form the basis for forensic analysis in chapter five. The themes are detailed in chapter five.

3.4 Limitations of the research.

While this study has endeavoured to give an encompassing solution to the research aims and objectives outlined in chapter one, the scope and size of the study must be realistically evaluated. The field of BIM and IPD are developing concepts within the Irish construction industry, and hence forms "a moving target"

from a research viewpoint. The pace of evolution within this field is stark, and dependent on international influences, government policy and technological advances. As associated software's become more affordable and widespread, processes will develop concurrently and the pace of change will accelerate.

This study concentrates on the status of BIM and IPD as it stands at this time in the Irish construction industry based on the views and experience of eight expert participants. The sample size is adequate for this study, however it is based on the views of the participating professionals. It must be acknowledged that policy decisions such as a government mandates as is the case in the UK, would have a dramatic effect on BIM usage within this jurisdiction. Also, the status of the Irish economy could play a major role going forward. While the current outlook is positive, this could be effected by international factors such as Brexit or the status of the world economy.

3.9 Research Design Summary.

This chapter has provided the background and reasoning behind the methodology utilised for this study. The aims and objectives inherent in this research formed the basis for research design, and subsequent choice of methodology. The chosen research strategy was qualitative in nature utilising a phenomenological approach. Semi structured interviews were deemed to be the most suitable platform for data collection, and this data was organised into solid themes for further analysis.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 Introduction.

This chapter documents the findings collected during the interview process. The research design presented in chapter three has been utilised in a structured manner to collect rich data from the sample of experts participating in this study. The interviews were arranged for times and dates agreed beforehand with selected participants who are listed in chapter three, along with the rationale for their selection The participants in question were all operating at director level within their organisations and in a position to provide the study with deep and meaningful data.

The semi structured nature of the interviews ensured that the time allocated for each interview was used efficiently, and a list of prepared questions are available in appendix 2. The data was transcribed by hand as a record of the proceedings. The interviews were rigorous which is a fundamental requirement of the phenomenological approach (Moustakos, 1994). The collected data has been packaged below under the overall structure of the question list. The responses are attributed to participants 1 to 8 as documented in chapter three. As discussed in chapter 3, significant statements were isolated from the bank of material and these formed the foundations for constructing the main themes. Using this strategy, irrelevant and surplus data was isolated and removed. The key themes were then abstracted at the end of this chapter, and analysed in depth in chapter five.

4.2 Procurement in the Irish Construction Industry.

Procurement in the Irish construction industry has evolved over the decades in line with the increasing size and complexity of projects. All eight participants have extensive experience in this area with the main methods across the board listed as: traditional, design & build and management systems. With regard to participants 7 and 8, this was purely educational and advisory in nature. The procurement routes in turn can be broken down into further subsections such as re-measurable, negotiated, cost plus and framework agreements as advised by participants 1 to 8. In this area, only two of the participants; 1&2, indicated that they had used a full IPD procurement route on past contracts. These two participants come from the main contracting sector which are among the contractors within the top ten turnover bracket in Ireland.

It is interesting to note that while all eight participants considered themselves as being involved in the use of BIM process on a regular basis, only two indicated involvement in a full IPD style procurement route. Participant 1 advised that the use of IPD as a procurement route on a number of projects was driven by the

clients, who were American multi nationals. Participant 2 also advised that the IPD procurement route also involved an American client.

4.3 BIM – Its status in the procurement arena

Participant 1 was dismissive of the quality of BIM input being currently adapted in procurement opportunities, which he described as "optics only". He further explained that BIM was often a buzz word among clients who did not fully understand what that entailed. This has resulted in a BIM model being a requirement in the procurement process, however this was only a tick box exercise as the models were basic with little embedded information. Participant 2 was in broad agreement noting "as it currently stands, it's an add-on as opposed to an integral part. Participants 3 and 4, from the architectural perspective were more positive about the current state of play who both advised that even basic models during the procurement stage provided the client with visualisation and walk through facilities which were not present without a model. Participant 4 felt that the production of even a basic model gave him an advantage over his competitors, as visualisation was a large marketing tool when sourcing clients. Participant 3 also advised on the merits of clash detection via navisworks even on a basic model, could add benefit and savings to the process. Participant 4 also noted that his company used archicad software which had the capability of producing both 2D drawings and 3D models, so he generally included some form of model with all procurement packages as a matter of course.

Participant 5 reinforced the views from 2 and 3; "My views are there is a lot of talk about BIM and its benefits, however a limited number of projects are using BIM properly and from the outset of projects" Participant 6 found that BIM was present in the form of models, however due to the way the models were constructed, quantification from a quantity surveying perspective was limited, with his company normally resorting to traditional on screen take off in 2D despite the presence of a model, again this plays into the optics category, models were often present but lacked quality embedded information. Participant 6 advised that collaboration had to take place at project inception so all professional could make use of the BIM model, for example the quantity surveyor has to educate the model creator on exactly what is required from the model from a QS perspective so quantification and cost control can become part of the process

Participant 7 noted that from an educational standpoint, students were being instructed in the use of BIM technologies, especially in the architectural department. However he noted a lack of collaboration among the various departments within the built environment which in his opinion didn't bode well for future collaboration in industry. Participant 8 who acts as an advisory to construction firms advised that "there is a compelling case for use of BIM presently", however there needs to be more education on its benefits, and this must be government driven.

4.4 Government Mandates

There was widespread knowledge among all eight participants on the UK's mandate with regards to BIM implementation in that jurisdiction. Participant 8, who has been involved in committee's advising the Irish government on policy in this area stated "I don't believe that Ireland will follow the UK in a blanket mandate, it will more likely be mandated for projects over a certain value threshold" This was backed up by Participant 5 who felt that Ireland generally follows the UK in these areas, as has been the case in building regulations and standards in the past, however again he does not want to see a blanket mandate; "I personally don't agree that it should be applied to all projects going forward, large projects yes, small projects no." Participant 7 was not entirely convinced that BIM implementation should be approached in this manner, "we should wait and see how the BIM mandate works out in the UK, and learn from any mistakes made there". He noted that in Germany they had adapted a "bottom up" approach where industry rather than the government was driving change and setting the agenda. He believed that this may lead to BIM and IPD being developed in a more organic way, rather than imposing a complete change in ideology on industry which could "shell shock" the system.

Participants 3 and 4 both felt that a government mandate would accelerate progress in this area. Participant 3 observed that a "push" is often required to make professionals sit up and take notice. Participant 6 was supportive under defined conditions. He talked about "projects of scale" and felt that it would be too costly on small projects. He was concerned that industry was not ready in terms of staff experience, and from his viewpoint the "fee was not there". He advised that fees in the Irish construction industry were too low as it was, and this would have to be addressed going forward. His final views on this area were that a mandate should be initiated only with strict parameters, and only on large scale projects.

There was consensus among the participants from the two main contractors. Participant 2 stated "yes if BIM is to get traction, the Irish government should mandate on a similar vein, there are no doubt lessons to be learned from the UK model that could be applied here". Participant 1 was also strong on this and advised that the economy was beginning to improve, and now was the ideal opportunity to introduce a mandate. His view was that "a government mandate was the only way it would work".

4.5 Integrated Project Delivery

The participants were asked about their understanding on IPD, and its use in Ireland at present. Participant 8 was very supportive of the IPD concept which "establishes an environment of collaboration and cooperation in which major stakeholders share in the risk in a formalised way on a construction or engineering project", however not used extensively in Ireland at this time. Participant 7 advised that his

understanding of IPD was “a procurement route that facilitates an integrated process for project delivery where the old silos are removed, and an integrated team is formed by project participants with a view to achieve the best possible outcome for the construction client in a cooperative non adversarial environment”. He noted that it was not common practice in Ireland, and significant work would have to be done in terms of work practice to facilitate an IPD approach.

Participant 1 described the process as a “collaborative, contractor early involvement procurement process”. He felt that it was a great system and his company were involved in projects of this nature in the Intel facility. He advised that a process of this nature required client buy-in. He advised that it was seldom used in Ireland due to a culture of poor collaboration between key stakeholders. Participant 2’s view was that “Integrated Project Delivery is basically all parties to the project collaborating during the course of the project, and achieved by sharing their work on a composite model, setting up collaborative reviews, utilising a common data environment”. Again like Participant 1, his company has been involved in IPD procured projects, however he also observed that “the process is in an embryonic stage in Ireland at present, and there are some projects using aspects of IPD”.

Participant 6 focused on “collaborative work and partnering” but felt that it was not fully utilised in Ireland with the exception of Intel. Participant 4 felt that it was an integrated approach, however thought that a major culture change was needed to really facilitate this approach. Participant 3 was supportive of the integrated philosophy, however he had reservations about ownership of the model and associated copyright problems, “Who is ultimately responsible for the project model?”

Participant 5 was a strong advocate of IPD, and felt there were strong links between lean construction and integrated project delivery. He noted than within the quantity surveying profession you get regular feedback from clients such as;

- Projects take too long!
- Projects cost too much!
- The team wasn’t cohesive!
- There were performance disappointments!
- Why can’t we get it right first time?
- What lessons from other industries have we learned?
- How can we eliminate waste?

In his opinion, there were opportunities out there to improve our industry and address the above problems, rather than continuing to use the same old methods. He felt that a combination of integrated project delivery

and lean construction had the potential answers to these problems. He noted that IPD was not widely used in Ireland at present, however educated repeat clients are seeking to improve project execution and IPD can certainly help this.

4.6 Collaboration in the Irish Construction Industry

The word synonymous with BIM and IPD is collaboration (Bouchlaghem D. , 2012). There is little doubt that without true collaboration among construction stakeholders and professionals, the development of BIM at any level is doomed to failure. Historically, procurement systems in Ireland have followed a similar path to UK, mainly due to historical links and a similar common law system. It is widely accepted that the contractual nature of this process in Ireland has resulted in adversarial relationships arising between stakeholders on many contracts. This adversarial environment has been exasperated during the recession in the industry over the last six years, where below cost tendering became a feature of the procurement process (O'Halloran, 2015). This was compounded by the Irish government when they opted for a new suite of contracts in 2007 for public works, which were viewed by main contractors as fundamentally unfair placing the burden of risk at their door (Kane, McAuley, Hore, & Fraser, 2015). The Irish government commenced a review of public works contracts in 2015 as a result of mounting pressure from construction professionals. "This review has called for public works contracts to be revised to include a more collaborative and co-operative approach" (Kane, McAuley, Hore, & Fraser, 2015). This study was concerned about gaining opinions from participants on the level of confrontation that currently exists, and whether collaboration can ever flourish in that kind of environment.

Participant 1 advised that the nature of procurement systems utilised in this country, and the subsequent contracts sow the seeds for confrontation. He has found a lot of mistrust between parties to a contract and this "all boils down to money!" He expanded on this statement that procurement systems in Ireland were so preoccupied with cost that relationships suffered as a result. He felt there "was almost a culture of trying to get one over on each other". He was optimistic that this could change in the future if realistic budgets were set at project inception, and there was transparency between all stakeholders with regard to fees and profit. Participant 2 observed that "it is somewhat of a misnomer to say that collaboration doesn't exist in the current structure, there has to be some collaboration on sites, and otherwise there wouldn't be a single project delivered!" He felt that responsibility and leadership had to be taken by the Irish government to create an environment that would enhance collaboration. "If we take the government suite of contracts, the risk allocation has led to a more adversarial approach, more disputes!" He advised that a sense of "fair play" must be inherent in the system for trust to develop, "If contracts are fair and risk is shared appropriately, collaboration can flourish".

Participant 5 disagreed with the perceived level of confrontation, "public sector work is confrontational and that is because of the ridiculous forms of contract that were introduced, private sector works generally work better once they are set up correctly from the outset". He also advised that collaboration can flourish if project stakeholders buy into the process from the outset. This was echoed by Participant 6 who felt that the lack of collaboration that currently prevailed in the Irish construction industry was a symptom of poorly thought out procurement strategies and contracts. He welcomed the idea of early contractor involvement in the project by utilising some form of two stage tendering in order to ensure competition. Participant 3 also felt that the notion that collaboration didn't exist in current practices was not legitimate. He used an interesting analogy when looking at collaboration, "if you look at the peace process in Northern Ireland as an example of how collaboration can be established, the current ruling parties were traditionally sworn enemies, who would not stand on the same platform, let alone talk to each other, while once a suitable peaceful environment could be established, the same protagonists could now form a government together…surely our task in construction is miniscule by comparison, create the correct environment and collaboration will flourish". Participant 4 was under no doubt on where the responsibility lay to develop this environment, "the government must take responsibility for creating a collaborative environment by introducing suitable contracts conducive to this type of arrangement",

Participant 8 also reiterated the point about creating the correct environment, which could only happen through appropriate procurement and contracts. Participant 7 felt there was a need for discourse between advisory organisations such as the Construction Industry Federation and the Construction IT alliance who should help inform government policy in this regard.

4.7 Facilitating Integrated Project Delivery

When it came to the question of what measures must be taken in the Irish construction industry to facilitate the use of IPD, there were different views on where the responsibility lay. Participant 1 stated that "it has to be the government!", and that they need to follow the lead of the UK government in introducing a mandate. This was echoed by Participants 3 and 4 who also felt that a government mandate was the necessary catalyst for implementing BIM and by association IPD.

Participant 2 was more focussed on promotion and education generally, "The benefits of this approach need to be highlighted and promoted, especially around the potential financial and programme gains, clients need to be educated". Participant 5 observed that "it's not rocket science, ensure that consultants and contractors highlight the benefits to clients, engage early with all parties, define goals, agree profit margins, work together to deliver it". Participant 6 felt that the industry must incentivise contractors to embrace this system, and explain to clients the potential financial gains.

Participant 8 advised that "the principles of IPD need to be fully adapted and integrated into project administration" and the development of contracts that will feed into this administration. Participant 8 was in much the same centre of thought, "we need common policy, policy documents, process documents to facilitate approach".

4.8 Barriers to Integrated Project Delivery

When barriers to IPD use in Ireland were discussed, two main areas emerged out of the interviewing process which were (1.) Policy (2,) Trust, and the general commentary covered these areas.

Participant 8 felt that culture within the Irish construction industry was a significant issue "It's a cultural problem mainly, and requires leadership and innovative thinking to break this mind-set". Participant 5 laid the gauntlet down to contractors to become more "IPD friendly" and "lack of trust is the main barrier, and transparency needs to improve from contractors". Participants 3 and 4 noted that a culture of confrontation had developed between contractors and the rest of the design team over decades, and this would have to be addressed. Participant 4 also alluded to better education and training would help to break down the prevalent silo mentality.

Participant 1 felt that government policy was the largest barrier, and that they must make a greater effort to encourage IPD use. Participant 2 was concerned with "the lack of a clear definition or strategy" which must be addressed through government intervention. He also noted that with the construction industry only climbing out of recession, the lack of financial investment in relevant systems posed a barrier. Participant 6 advised that a change to regulations on procurement was required, and the absence of appropriate standard forms of contract in Ireland posed a major barrier. Participant 7 noted "the unwillingness to try something new", and general conservatism which was prevalent in government policy.

4.9 International Influences

The international influence and world view experience is an important component within the IPD story in this country. Participant 7 felt that the UK mandate was what first thing that came to mind, however he was not advocating a replication of this policy. He noted that there were also similar mandates in Australia, Scandinavia to his knowledge. He felt that CITA were doing good work in this area in Ireland to educate practitioners on developments elsewhere, and provided information on best practice in the international domain. Participant 8, who represents CITA, advised that documentation from the American Institute of Architects was a great source of information for those researching this area, and should be compulsory reading for all stakeholders in the Irish construction industry. Participant 6 had experience of this system in Australia, where he felt that the construction industry were more "mature" and "not just obsessed with

the bottom line". We have to learn from international experience, and this should be enhanced by construction professionals returning from abroad

Participant 2 noted that foreign direct investment would influence future approaches as multi nationals will have utilised IPD in other markets and will have the same expectations here. He advised that due to our low corporation tax, more and more multinationals were attracted to these shores and would expect outcomes in line with abroad. This was supported by Participant 2 who had experienced this approach when carrying out projects for Intel. Participant 5 also pointed to Intel as "leading the charge" on IPD, and advised that "as they are one of the biggest spenders on construction work in Ireland, other companies are beginning to take note".

The UK mandate was a continuous theme when discussing international influences, and this was the main argument from Participants 3 and 4, who advised that there is a "wait and see" approach on how that mandates works out over the coming years.

4.10 Viability – Going forward!

The final part of the interview dealt with viability of this process going forward, and their views on whether a full IPD procurement route was a viable procurement route in the Irish construction industry. There was generally a positive response with conditions attached!

Participant 1 observed that "if this route is not viable, there is something seriously wrong with our industry" and felt that with changes in government contracts and policy could facilitate the widespread use of IPD over a very short time span. Participant 2 was positive but outlined the need for change, "it depends on the framework, and the requirements, for it to become viable, there will be a sea change needed from all parties, clients need to be educated, design teams and early contractor involvement will have to become the norm". Participant 3 felt that "clients get what they want as they hold the purse strings" so the key to this is selling the benefits to perspective clients. Participant 4 noted that if the approach proves economical for clients that will drive more usage.

Participant 5 was quite confident that it was a viable procurement route, "Yes but only in the private sector at present, and on large projects where clients are professional in their approach and are involved in projects on a continuous basis". Participant 6 was again positive on this topic, "yes, on certain projects, especially where time is the priority". He noted that different clients had different priorities, and cost was not always the key priority. Participant 7 felt that it was viable, however the IPD system must be tailored to suit the Irish construction industry. Participant 8 advised "not at present, there are too many vested interests in the Irish construction industry, and blockages in respect to procurement adoption in Ireland".

4.11 Themes arising

As outlined in chapter 3, Moustakos (1994) discusses the interpretation of collected data and the importance of deriving overriding themes which will form the basis for analysis and subsequent conclusions. The overall goal inherent in the interviewing process was to collect rich, concise and innovative material, eliminating extraneous material, ultimately providing the armoury necessary to tackle the research questions posed. This study has produced eight key themes elicited from the collected data, and these form the basis for forensic analysis in chapter five. The themes are as follows;

- Theme 1 – Conservatism in choice of procurement route.
- Theme 2 – BIM in Ireland – optics only!
- Theme 3 – Government mandate.
- Theme 4 – Need for collaboration.
- Theme 5 – Lack of trust.
- Theme 6 – International companies.
- Theme 7 – IPD, What it really means!
- Theme 8 - Education

These themes form the basis for data analysis in chapter five from which conclusions on the research question are derived.

4.12 Summary

The purpose of this chapter was to practically apply the research design and methodology outlined in chapter three, in order to answer the overall research question and deal with the overall aims and objectives of the study. Key themes have arisen from the data collected during the interviewing process, and are analysed in detail in chapter five.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Introduction

The findings presented in Chapter Four included a comprehensive breakdown of the interview discussions arising from experts in the field of BIM and IPD. This chapter has utilised the rich data gathered during that process and provides an in depth analysis of this data. Again it is prudent to reflect on the overall aim of this study which is detailed in chapter one

The overall aim of this thesis is ***to investigate whether Integrated Project Delivery is a viable procurement route for construction work within the Irish construction industry.***

This aim was supplemented by aims and objectives listed in chapter one, and a careful interrogation of gathered data provides the basis for addressing aforementioned aims and objectives.

5.2 Main themes arising from findings

The key themes have been abstracted from the data presented in chapter five. These themes are now utilised to form the basis of meaningful conclusions. This analysis also links back to the literature review contained in chapter two which sets the stage for this research. This analysis is in line with the step by step methodology outlined in chapter three.

- Theme 1 – Conservatism in choice of procurement route.
- Theme 2 – BIM in Ireland – optics only!
- Theme 3 – Government mandate.
- Theme 4 – Need for collaboration.
- Theme 5 – Lack of trust.
- Theme 6 – International companies.
- Theme 7 – IPD, What it really means!.
- Theme 8 - Education

5.3 Conservation in choice of procurement route.

There appeared to be a reluctance among participants to embrace new processes in this area. All participants had working knowledge of the normal routes; traditional, design & build, and management systems,

however only two had working knowledge of IPD. The overarching reasoning offered for this was given as client choice and their reluctance to stray from more "tried and tested" approaches. There was also general criticism of government policy in this area with little appetite in that sector for pursing innovative procurement routes.

There was a general feeling that there was a knowledge deficit among all stakeholders in the Irish construction industry relating to BIM and IPD, and a greater effort must be made to publicise these systems with regard to the time, cost and quality perspectives. The evidence arising from this theme pointed towards the need for change in government policy and the requirement for education in this area.

5.4 BIM in Ireland – Optics only!

This theme was very obvious in much of the commentary from participants on how BIM is currently used. They all had working knowledge of BIM technologies, however felt in many cases it was only present as a "box ticking" exercise. 3D models were included in many projects to give clients the impression that BIM was being used, however the models were deficient in embedded information and there was a lack of collaboration between the different disciplines.

Participants were supportive of using basic BIM models for visualisation and clash detection purposes, however had little experience of true collaboration. The consensus among participants was that for collaborative BIM to take hold, there was a major requirement for changes in culture and policy to facilitate this process.

5.5 Government mandate

The government mandate introduced in the UK was a topic for discussion throughout the interview process. The general view was that some form of BIM mandate should be introduced in this country, however not a blanket mandate as introduced in the UK. The view was that the mandate should have parameters, i.e. projects over a certain cost and magnitude.

A number of participants suggested that a "wait and see" approach should be adopted where we can learn from the results of the UK mandate over the next number of years. A number of participants also advised that mandates existed in Australia and Scandinavia, and these also warrant investigation before an Irish version is formulated.

The view prevailed that for BIM to gain real traction in Ireland, a government mandate in some form was necessary, however it should not be overly prescriptive in its nature

5.6 Need for collaboration

A notable statement from Participant 2 in relation to collaboration among disciplines in the Irish construction industry was that "it is somewhat of a misnomer to say that collaboration doesn't exist in the current structure, there has to be some collaboration on sites, and otherwise there wouldn't be a single project delivered!" This statement clarified that it wasn't a case that no collaboration existed in our industry, however the level of that collaboration was the issue. A number of areas became apparent during the interviewing process. There was a view that the adversarial nature of existing contractual and procurement systems was a key reason for poor collaboration. The government was criticised for inflaming the adversarial nature through the public work contracts which were found to be unfair. It was noted that much of the poor collaboration within the Irish construction industry is a symptom of poorly thought out procurement strategies and contracts. The conclusion arising from this theme was that if a suitable environment is developed, collaboration will flourish among construction professionals

5.7 Lack of trust

The perceived lack of trust between main contractors and other design professionals is well founded, and participants felt that again this was a symptom of the adversarial nature inherent in our existing procurement and contractual arrangements. It was felt by a number of participants that this lack of trust was a fundamental barrier to the implementation of IPD strategies. However there was also a view that this trust issue was overstated and would dissipate once new collaborative systems were experienced. Experience of collaborative systems would help inform stakeholders and build confidence among professionals.

5.8 International companies

All participants were cognitive of the substantial influence that multinational companies have on the development of IPD in this country and the guidance that they can provide in relation to best practice. A number of participants pointed to Intel and associated construction projects as a guiding light on IPD implementation.

Two of the participants who had been involved with IPD on live projects, noted that it was down to the fact that the clients were American based, and had expectations of the same project outcomes that were experienced in their home countries.

The overarching view was that construction professionals here must learn from international influences, and assimilate this new knowledge into our domestic industry, informing clients of the economic benefits to be gained from these innovative processes.

5.9 IPD – What it really means

The terminology surrounding BIM and IPD can attract numerous definitions, many of which were explored in the literature review. The term that is common to all of these definitions is "collaboration" which is contained in much of the dialogue during the interview process.

One participant provided his own definition:

Integrated Project Delivery "establishes an environment of collaboration and cooperation in which major stakeholders share in the risk in a formalised way on a construction or engineering project",

5.10 IPD – Education

The bank of knowledge relating to IPD in Ireland is still limited due to the process being a relatively new concept in the Irish construction industry. From an educational viewpoint, this does not only focus on students completing construction related courses in third level colleges, but all of the main stakeholders in the Irish construction industry. Participants talked about client awareness, and the need to advise clients on the benefits of adopting this innovative process.

Client awareness with regards to IPD for this process to attract widespread use.

5.11 Overview,

The research findings must be correlated with the aims and objectives of the thesis;

- ***Outline current procurement routes being used in Ireland at present for construction projects.***

  The evidence gathered in this study found that clients are conservative with regards to their selection of procurement route, generally using; Traditional, Design & Build and Management, or some form of these routes. IPD is rarely utilized, except by international companies on a small number of known projects.

- ***Define IPD (Integrated Project Delivery)***

  There are many definitions for this process, many of which are explored in chapter 2, however one participant provided a definition which encompasses the views expressed by all participants during the research process; Integrated Project Delivery establishes an environment of collaboration and co-operation in which major stakeholders share in the risk in a formalized way on a construction or engineering project.

- ***Investigate the level of uptake with regards to IPD as a procurement route on construction projects in Ireland and barriers to its implementation.***

  This research has shown that there is a very small uptake of IPD as a procurement route in Ireland, only on a small number of projects with international clients.

  There are many barriers to IPD implementation;

  - Irish government policy
  - Existing contractual arrangements
  - Culture
  - Trust
  - Education
  - Client awareness
  - Conservative nature of industry

- ***Propose guidelines on proposed best practice in relation to main contractor selection for future IPD projects in the Irish construction industry***

  The proposed guidelines going forward, derived from data gathered during this study include;

  - Introduction of a government mandate on all public works projects with parameters, i.e. over a certain value (to be determined)
  - Development of a new suite of standard forms of contract that can facilitate the use of Integrated Project Delivery
  - Creation of a multi-disciplinary advisory board to assess the implications of mandates imposed in UK, Australia and Scandinavia on what form it should take in this country. And to provide CPD for potential clients, contractors and construction professionals

In relation to the overall aim of this thesis is ***to investigate whether Integrated Project Delivery is a viable procurement route for construction work within the Irish construction industry.***

The conclusion based on the data gathered during this research is that IPD is a viable procurement route for construction work within the Irish construction industry, on condition that the Irish government makes policy decisions conducive to creating a collaborative environment of trust. This policy must deal with procurement regulations, contractual arrangements and promotion within the industry itself

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The Irish construction industry has emerged from a devastating economic recession, and is currently at a transitional stage, faced with reduced fees, higher client demands for that fee and increased responsibility (Kane, McAuley, Hore, & Fraser, 2015). There is widespread agreement among key stakeholders in the industry that we are exposed to unprecedented times in relation to technological and economic change (Buildcost, 2015). There is consensus among stakeholders that the experiences encountered due to economic collapse have acted as a catalyst for major change (Burke-Kennedy, 2014). Construction professionals now realise that adoption of leaner work practices are fundamental to survival in an increasingly competitive market (Kane, McAuley, Hore, & Fraser, 2015).

The recession forced many main contractors and construction professionals to source work overseas, specifically in the UK, where adaption of BIM and associated technologies is increasingly significant (RICS, 2014). This exposure has educated stakeholders to the benefits of BIM and associated systems. To assist in the recovery of the construction industry here, the Forfas report (2013) stated "that in order to maintain competitiveness, Irish construction firms must comply with evolving building/product regulations and exceed international industry standards with the use of BIM based integrated project management (Kane, McAuley, Hore, & Fraser, 2015, p. 120)." This set the stage for the research completed in this study where an investigation was carried out to gauge the level of change and appetite for embracing new technologies and processes

6.2 Review of the Research Question.

The overall aim of this thesis has acted as the navigation process for all chapters stemming from chapter 1. The primal research question that forms the basis of this study is ***to investigate whether Integrated Project Delivery is a viable procurement route for construction work within the Irish construction industry.***

The question has been answered based on the data gathered during the research process, supplemented by findings in the literature review. The overall conclusion based on the data gathered during this research is that IPD is a viable procurement route for construction work within the Irish construction industry, on condition that the Irish government makes policy decisions conducive to creating a collaborative environment of trust. This policy must deal with procurement regulations, contractual arrangements and promotion of IPD within the industry itself

6.3 Recommendations based on findings

The recommendations arising from this body of work echo the observations of experts on the Irish construction industry. Evidence gathered during the study provides an insight into the conservative nature of procurement in the Irish construction industry. There was found to be an over reliance on what could be described as traditional systems with scant evidence of IPD being treated as a legitimate option. There was consolidation of the view expressed by Deeney et al (2013) who have advocated the need for government involvement, "In order for BIM to become a reality, the Irish Government must become the main driver in this process and, review current BIM initiatives and barriers in public sector procurement bodies in other international countries (Deeney, Hore, & McAuley, 2013, p. 21)". This has been reinforced by the findings in this research

There was a common theme running through the literature on the need for cultural change and the requirement for a change to work practices (Smith, 2014). The Irish construction industry is conservative by nature (Boylan, 2015), and the level of change outlined in this study is a huge undertaking. Irish construction firms have become accustomed to carrying out business in a manner that has evolved over decades, and there is an obvious challenge in changing that culture. This again is in line with the main findings of this research which has found that there are a number of barriers that must be addressed;

- Irish government policy
- Existing contractual arrangements
- Culture
- Trust
- Education
- Client awareness
- Conservative nature of industry

Drawing from the literature reviewed in chapter two and the main body of research covered in chapters four and five, a number of clear recommendations are proposed by the author;

- Introduction of a government mandate on all public works projects with parameters, i.e. over a certain value (to be determined)
- Development of a new suite of standard forms of contract that can facilitate the use of Integrated Project Delivery

- Creation of a multi-disciplinary advisory board to assess the implications of mandates imposed in UK, Australia and Scandinavia on what form it should take in this country. And to provide CPD for potential clients, contractors and construction professionals

6.4 Recommendations for further research.

One could state that research surrounding BIM and IPD is a moving target due to the fast pace of change in this field. Technologies are evolving on a monthly rather than an annual basis, and there are constant innovations associated with this area. This study has highlighted the limited bank of knowledge surrounding IPD, and the low uptake of this procurement route in Ireland. This uptake needs to be monitored going forward, with research conducted on remaining barriers that may arise.

A substantial amount of research is required in relation to Irish government policy on BIM over the next number of years. They have called for a more collaborative and co-operative approach to be adapted in their review of the public work contracts, and this has to be monitored to assess whether a true commitment exists or a mere aspiration.

The literature review on this study has highlighted the benefits of BIM and IPD on the international stage, and there is no apparent reason why these benefits cannot be realised in this jurisdiction. There is a need for continuing research in this area from an Irish perspective to inform all construction stakeholders of the potential benefits available by adopting these practices.

References

AIA. (2007). *Integrated Project Delivery - A Guide.* California: American Institute of Architects.

Alarcon, I., Christian, D., & Tommelein, I. (2011). Collaborating with a Permitting Agency to deliver a healthcare project: A case study of the Sutter Medical Centre Castro Valley. *Proceedings of the 19th Annual Conference of the International Group for Lean Construction*, (pp. 1-12). Lima, Peru.

Aouad, G., Lee, A., & Wu, S. (2005). nD Modelling for collaborative working in construction. *Architectural Engineering & Design Management*, 33-44.

Arayici, Y., Coates, P., Koskela, L., Kagioglou, M., McCall, J., & O'Reilly, K. (2014). BIM Implementation for an Architectural Praxtice.

Arensman, D., & Ozbek, M. (2012). Building Information Modelling and Potential legal issues. *International journal of Construction Education and Research*, 146-156.

Ashworth, A. (2010). *Cost studies of buildings.* London: Pearson.

Atkinson, R., Cawford, L., & Ward, S. (2006). Fundamental uncertainties in projects and the scope of project management. *International Journal of Project Management*, 687-698.

Auburn, T. (2007). Identity and Placement Learning: Student accounts of the transition back to university after a placement year. *Studies in Higher Education, 32*(1), 117-133.

Azhar, S., Hein, M., & Sketo, B. (2008). Building Information Modelling (BIM): Benefits, risks and challenges. *44th ASC Annual International Conference* (pp. 2-3). Auburn, Alabama: Auburn University.

Baccarini, D. (1996). The concept of project complexity - A review. *International Journal of Project Management, 14*(4), 201-204.

Bartlett, S., Butler, D., & Peim, N. (2001). *Introduction to Education Studies.* London: Paul Chapman.

Bouchlaghem, D. (2012). *Collaborative Working in Construction.* London: Spon Press.

Boylan, P. (2015). A better way to work? *Surveyors Journal, 5*(1), 14-15.

Bryman, A. (1998). *Quantity and Quality in Social Research.* Unwin Hyman.

Bryman, A. (2012). *Social Research Methods.* UK: Oxford University Press.

BSL. (2014). *BS1192-4 Collaborative production of information Part 4, Fullfilling employers information exchange requirements using COBie - Code of practice.* UK: British Standards Institution.

Buildcost. (2015). *Construction cost guide - second half 2015.* Dublin: Buildcost.

Buildcost. (2015, Jan 4). *Construction Cost Guideline 2015*. Retrieved May 4, 2015, from Buildcost: http://www.buildcost.ie/wp-content/uploads/2015/02/BuildcostConstructionCostGuideFeb2015.pdf

Burke-Kennedy, E. (2014, May 14). *Government unveils €200m stimulus for construction sector*. Retrieved April 3, 2015, from The Irish Times: http://www.irishtimes.com/business/economy/government-unveils-200m-stimulus-for-construction-sector-1.1794757

Casey, R. (2015). DPS - From good to great with lean. *Irish Building*, 39-41.

Cheung, T., Rihan, J., Tah, J., Duce, D., & Kurul, E. (2012). Early stage multi-level cost estimation for schematic BIM models. *Automation in Construction*, 67-77.

CMAA. (2009). *Managing Integrated Project Delivery.* CMAA.

Cohen, L., Mannion, L., & Morrison, K. (2000). *Research Methods in Education.* London: Routledge Falmer.

Colledge. (2005). Relational Contracting - Creating value beyond the contract. *Lean construction journal, 2*(1), 1.

Comiskey, D., McLernon, T., Fleming, A., & Harty, J. (2015). Applying lean principles to higher education via a collaborative delivery approach. *CITA BIM Gathering Proceedings* (pp. 238-248). Dublin: CITA.

Coughlan, R. (2004). From the challenge to the response. *BiTE Project Conference*, (pp. 2-28). Adstral Park.

Creswell, J. (2003). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches.* London: Sage Publications.

Creswell, J. (2007). *Qualitative inquiry and research design.* London: Sage Publications.

Crotty, M. (1998). *The Foundations of Social Research.* London: Sage Publications.

Cunningham, G., McClements, S., & McKane, M. (2015). BIM Implementation Developments for Architecture, Engineering and Construction organisations in the UK. *CITA BIM Gathering Procedings*, 22-28.

Daore-Pool, L., & Sewell, P. (2007). The key to employability: Developing a practical model of graduate employability. *Education and Training, 49*(4), 277-289.

Deeney, J., Hore, A., & McAuley, B. (2013). Public / Private BIM; An Irish perspective. *Proceedings of the BIM gathering 2013*, 25-34.

Denscombe, M. (2010). *Ground Rules for Social Research.* London: Open University.

Denzin, N., & Lincoln, Y. (2000). *Handbook of Qualitative Research.* London: Sage.

Dep of P.E, &. (2016, June 20). *Welcome the construction procurement reform website*. Retrieved from Construction Procurement Reform: http://constructionprocurement.gov.ie/

DKM. (2012). *The Irish Construction Industry in 2012.* Retrieved September 4, 2012, from DKM Reports: http://www.dkm.ie/uploads/pdf/reports/irish%20construction%20industry%20in%202012%20dkm%20scsi.pdf

Eastman, C., Teicholz, P., Sachs, R., & Liston, K. (2011). *BIM Handbook : A guide to Building Information Modelling for Owners, Managers, Designers, Engineers and Contractors.* Hoboken NJ: Wiley.

Ebbs, P. (2015). Lean Project Delivery. *Irish Building*, 34-35.

Eraut, M. (2008). *How professionals learn through work.* Retrieved November 29, 2012, from Learning to be professional: http://learningtobeprofessional.pbworks.com/w/page/15914995/michael20eraut

Flanagan, R. (1999). *Linking construction research and innovation to research innovation in other sectors.* CRISP.

Forfas. (2013, 12 31). *Forfas Annual Report 3103*. Retrieved from Forfas: https://djei.ie/en/Publications/Publication-files/Forf%C3%A1s/Forf%C3%A1s-Annual-Report-2013.pdf

Fraser, S. (2014, July 3). *How BIM can be adapted within public works contracts*. Retrieved June 12, 2016, from The Engineers Journal: http://www.engineersjournal.ie/2014/07/03/how-bim-can-be-adopted-within-public-works-contracts/

Fu, C., Kaya, S., Kagioglou, M., & Aouad, G. (2007). The development of an IFC based lifecycle costing prototype tool for building construction maintenance. *Construction Innovation, 7*(1), 85-99.

Gillham, B. (2000). *The Research Interview.* London: Continuum.

Gray, D. (2006). *Doing research in the real world.* London: Sage.

Gu, N., & London, K. (2010). Understanding and facilitating BIM adaption in the AEC industry. *Automation in Construction*, 988-999.

Hackett, M., Robinson, I., & Statham, G. (2009). *The Aqua Group Guide to Procurement, Tendering & Contract Administration.* Oxford: Blackwell Publishing.

Hannele, K., Reijo, M., & Tarja, M. (2012). Expanding uses of building information modelling in life cycle construction projects. *Work41*, (pp. 114-119).

Hannock, C. (2011, April 4). More jobs lost in construction sector as new orders decline. *The Irish Times*, p. 4.

Henstridge, J. (2011). Construction in the UK and Ireland on the mend, but recovery is slow and unsteady. *The European Business Review.*

Hore, A., O'Kelly, M., & Scully, A. (2009). *Seeley and Winfields Building Quantities Explained.* London: palgrave macmillan.

Kane, R., McAuley, B., Hore, A., & Fraser, S. (2015). Collaborative public works contracts using BIM - An opportunity for the Irish Construction Industry? In A. Hore (Ed.), *CITA BIM Gathering Proceedings* (pp. 118-125). Dublin: The Construction IT Alliance.

Koskela, L. (1992). *Application of the new production philosophy to construction.* Stanford: Stanford University.

Latham, M. (1994). *Constructing the team.* London: HMSO.

Laufer, A., Denker, G., & Shenhar, A. (1996). Simultaneous management: the key to excellence in capital projects. *International Journal of Project Management, 14*(4), 189-199.

LCI. (2013). *Integrated Project Delivery.* London: Lean Construction Institute.

Liker, J. (2004). *The Toyota Way.* USA: McGraw-Hill.

Lynch, S. (2011, August 23). *Surveyors say over half of tenders below cost*. Retrieved June 17, 2016, from The Irish Times: http://www.irishtimes.com/business/commercial-property/surveyors-say-over-half-of-tenders-below-cost-1.604402

Maguire, D. (2014, May 5). *Building Information Modelling - Boom, Bang Bing*. Retrieved from Irish Building: http://www.irishbuildingmagazine.ie/2014/05/05/building-information-modelling-boom-bang-bim/

Mason, J. (2002). *Qualitative Rresearching.* London: Sage.

Mathews, M. (2015). Defining job titles and career paths in BIM. *CITA BIM Gathering 2015* (pp. 33-35). Dublin: CITA.

Mathews, O., & Howell, G. (2005). Innovative Contractual Structure. *Lean Construction Journal, 2*(1), 46-61.

McAuley, B., Hore, A., & Deeney, J. (2013). Public / Private BIM: An Irish Perspective. *CITA BIM Gathering* (pp. 25-34). Dublin: CITA.

McAuley, B., Hore, A., & West, R. (2012). Use of BIM in reponding to low carbon construction innovations: An Irish Perspective. *Joint CIB International conference on management of construction .* Montreal: Research & Practice .

McCauley, B., Hore, A., West, R., & Kehily, D. (2013). Addressing the need to reform construction public procurement in ireland through the implementation of building information modelling. *Research Development and practice in Structural engineering and construction*, 1-6.

Merriam, S. B. (2002). *Qualitative Research in Practice: Examples for study and discussion.* San Francisco: Jossey-Bass.

Molloy, C. (2015, February 9). *The public works contracts; where do we go from here?* Retrieved from Irish Building: http://www.irishbuildingmagazine.ie/2015/02/09/the-public-works-contracts-where-do-we-go-from-here/

Moustakos, C. (1994). *Phenomenological Research Methods.* London: Sage Publications.

Naoum, S. (1998). *Dissertation Research & Writing for Construction Students.* Oxford: Buttersworth-Heinemann.

NBC. (2016, June 1). *NBC.* Retrieved from NBC: http://www.nbcireland.ie/council-members/

NQAI. (2012, September 25). Retrieved December 2, 2012, from http://www.nfq.ie/nfq/en/

Nugent, A. (2016, March 7). A nation once again - with housing? *Surveyors Journal, 6*(1), 4.

O'Halloran, B. (2015, December 30). *The property developers who have survived the crash*. Retrieved June 20, 2016, from The Irish Times: http://www.irishtimes.com/business/commercial-property/the-property-developers-who-survived-the-crash-1.2479730

O'Higgins, N., & Mahony, M. (2015). Constructing in 2015 and beyond! Changes on the horizon. *Irish Building*, 5.

Oktay, J. (2012). *Grounded Theory.* Oxford: University Press.

Opie, C. (2004). *Doing Educational Research: A Guide for first time researchers.* London: Sage.

Percival, G. (2012, April 23). *1500 jobs in pipeline*. Retrieved from The Irish Examiner: http://www.irishexaminer.com/business/1500-construction-jobs-in-pipeline-191496.html

Pickens, D., & Jagger, D. (2005). Whither Measurement. *RICS Journal, 12*(5), 45.

Pishdad-Bozorgi, P., Hamzanlui-Moghaddam, E., & Karasulu, Y. (2013). Advancing Target Price and Target Value Design Process in IPD using BIM and Risk Sharing Approaches. *49th ASC Annual International Conference Proceedings* (p. 1). Associated Schools of Construction.

Pittard, S., & Sell, P. (2016). *BIM and Quantity Surveying.* Oxford: Routledge.

Redmond, A., Hore, A., West, R., Underwood, J., & Alshawi, M. (2011). Developing a cloud integrated life cycle costing analysis model through BIM. *CIB International Conference* (pp. 78-102). Sophia Antipolis, France: CIB.

RICS. (2012, December 1). Retrieved December 1, 2012, from http://www.rics.org/us/about-rics/who-we-are/history-and-mandate/history/

RICS. (2013, January). *The Profession*. Retrieved January 7, 2013, from RICS Homepage: http://www.rics.org/ie/the-profession/

RICS. (2014). *Overview of a 5D BIM project.* London: RICS. Retrieved from BIM TASK GROUP: http://www.bimtaskgroup.org/

Robson, C. (2002). *Real World Research: A Resource for Social Scientists and Practitioner Researchers.* Oxford: Blackwell.

Robson, C. (2011). *Real World Research.* UK: J Wiley & Sons Ltd.

Roper, S. (1997). Product innovation and small business growth: A comparison of the strategies of German, UK and Irish companies. *Small Business Economics*, 523-537.

Russell, R. (2004, September). Professional Studies in Architure: Architectural Education and Work Based Learning. *CEBE Transactions, 1*(1), 56-88.

Sampson, H. (2004). Navigating the waves; the usefulness of a pilot in qualitative research. *Qualitative Research*, 383-402.

SCSI. (2011). Retrieved December 16, 2011, from http://www.scsi.ie/what_is_a_surveyor/membership/how_do_i_join

SCSI. (2011). *SCSI / RICS Review of Construction Economics and Management Degree Course.* Dublin.

SCSI. (2012). Retrieved November 30, 2012, from http://www.scsi.ie

SCSI. (2015). *Irish construction prospects to 2016.* Dublin: SCSI.

SCSI. (2016, January 31). *Bruce Shaw Handbook*. Retrieved June 12, 2016, from Bruce Shaw: http://edition.pagesuite-professional.co.uk/launch.aspx?pbid=9b25d463-b7cf-47e5-b624-ecd0d560185b

SCSI. (2016, January 12). *Irish construction prospects to 2016*. Retrieved from Irish construction prospects 2016: file:///C:/Users/fiacra.mcdonnell/Downloads/SCSI_Irish_Construction_Prospects_DKM_Final_Report_8April2015.pdf

Scully, D., Caeleton, J., & Quinn, M. (2011). *Bruce Shaw website.* Retrieved May 12, 2012, from Irish Construction Output Statistics, The Bruce Shaw Handbook: http://www.bruceshaw.com/conmun.craft-cws-system/uploads/BS-handbook-2011-pdf

Simons, H. (2009). *Case Study Research in Practice.* London: Sage.

Smith, P. (2014). BIM and the 5D Cost Manager. *Procedia-Social and Behavioral Sciences*, 475-484.

Smyth, H., & Pryke, S. (2008). *Collaborative Relationships in Construction.* Oxford: Blackwell Publishing Ltd.

Stewart, P. (2014). *BIM - AN OVERVIEW OF THE PROCESS FROM AN IRISH CONSTRUCTION PROJECT MANAGEMENT PERSPECTIVE*. Retrieved May 5, 2015, from irishconstruction.com: http://www.irishconstruction.com/building_information_modelling_an_overview_of_the_process_from_an_irish_construction_project_management_perspective.PAGE3164.html

Tier BIM Consults. (2015). It's not just some fancy 3D modelling. *Irish building*, 71-72.

UOS. (2012). *Programme handbook for MSc in BIM & Integrated Design.* Manchester: University of Salford.

Van Manen, M. (1997). *Researching Lived Experience: Human Science for an action sensitive pedagogy.* London Ontario: Althouse Press.

Vygotsky, L. (1978). Interaction between Learning and Development. *Mind and Society*, 79-91.

Wallwork, J. (2015). The rise of the BIM consultant. *Irish Building*, 50.

Williams, T. (1999). The need for new paradigms for complex projects. *International Journal of Project Management, 17*(5), 269-273.

Winter, M., & Szczepanek, T. (2008). Projects and programmes as value creation processes: A new perspective and some practical implications. *International Journal of Project Management, 26*, 95-103.

Zimina, D., Ballard, G., & Pasquire, C. (2012). Target Value Design: using collaboration and a lean approach to reduce construction cost. *Construction Management and Economics, 30*, 383-398.

APPENDIX 1

University of Salford MANCHESTER

School of the Built Environment

Ethics Feedback Form

Student Name:	Fiacra McDonnell	**Student ID:**	@00254012
Supervisor:	Sara Biscaya	**Ethics Reviewer:**	Marcus Ormerod
Project Title:	Main contractor selection on construction projects when adapting an "Integrated Project Delivery" procurement strategy within an Irish context.		

Feedback on Ethical Approval Application

Based on documentation submitted ethical approval is granted.

Description	Decision
Type 2 – Approved This is a Type 2 project. Provided that you address feedback set out above (if any) to your Supervisor's satisfaction, and that you carry out your data collection substantially in accordance with the procedure you have described, and using the explanatory and confirmatory documentation supplied, then you have ethical approval for your research.	**APPROVED**

IMPORTANT REMINDER - EXTENSIONS

CHECK THAT YOU KNOW KNOW WHEN YOUR RESEARCH PHASE ENDS. IF YOU REQUIRE AN EXTENSION (AND ARE STILL ENTITLED TO ONE) ENSURE THAT YOU REQUEST IT BEFORE YOUR RESEARCH PHASE ENDS. DETAILS OF HOW TO REQUEST AN EXTENSION ARE IN THE HANDBOOK.

IF YOU HAVE QUERIES, CONTACT sobe-programme-support@salford.ac.uk

APPENDIX 2

RESEARCH AIM; To investigate whether Integrated Project Delivery is a viable procurement route for construction work within the Irish Construction Industry.

1. What are the main procurement routes used / experienced by your organisation when involved in the procurement of construction work within an Irish context?

2. What are your views on the use of Building Information Modelling technologies / process when involved in the procurement of construction work as it stands at present?

3. Should the Irish government follow the lead of their UK counterparts by introducing a BIM mandate for all public financed work going forward?

4. What is your understanding of the term "Integrated Project Delivery", and what are your views on the use of this process in Ireland at present/

5. The overall procurement of construction work within the Irish construction industry can be characterised as a confrontational process, prone to disputes and contractual discourse! What are your views on this statement? Can collaboration between stakeholders ever flourish in this kind of environment?

6. What measures have to be taken in the Irish Construction industry to facilitate the use of Integrated Project Delivery?

7. What barriers currently exist within the Irish Construction Industry against the use of Integrated Project Delivery as a viable and successful procurement route?

8. Can you point to what you view as International influences which may act a guiding light for future developments in this area?

9. Overall, do you think that Integrated Project Delivery is a viable procurement route for construction work within the Irish context?